STATE OF ALASKA

DEPT. OF ENVIRONMENTAL CONSERVATION
DIVISION OF SPILL PREVENTION AND RESPONSE
CONTAMINATED SITES PROGRAM

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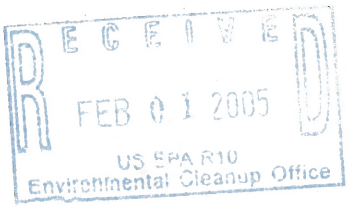
File: 108.38.106

January 25, 2005

Mr. Ken Marcy
ECL-115
US EPA Region 10
1200 6th Avenue
Seattle, WA 98101



Re: Pedro Dome Documents

Dear Ken:

Here are copies of the documents we discussed. I will keep you posted regarding the upcoming statistical analysis. If you have any other questions or need additional information, please don't hesitate to contact me sharon_richmond@dec.state.ak.us or 907-451-2158.

Sincerely,

Sharon Richmond
Environmental Specialist

Richmond, Sharon

From: Eppie Havel [Eppie@oasisenviro.com]
Sent: Thursday, November 18, 2004 1:47 PM
To: 'Sharon_Richmond@dec.state.ak.us'
Cc: Max Schwenne; Eppie Havel
Subject: Pedro Dome Risk Calculations Analysis

Hi Sharon,

Here is a pdf copy of the letter report. A signed version is in the mail to you.

Per our telephone conversation today, I am submitting a separate commentary (below) on other issues noted during review of the risk assessment.

Other Considerations - Pedro Dome Risk Calculations Analysis

Exposure by dermal contact is not considered a completed pathway in this risk assessment. The dermal route of exposure is recognized as a significant contributor of PCB accumulation in exposed individuals (RAIS, 2004). The risk assessment states that this pathway was eliminated because the cooler temperatures at the Pedro Dome site are not 'conducive to short sleeves and pants'. A limited area of exposed skin is not an ideal reason to eliminate an exposure pathway. In this example, the risk calculations could be restricted to contaminant contact with hands and face if the rest of the body is assumed to be adequately covered. Eliminating the dermal contact exposure pathway may result in an underestimation of site risk.

OASIS calculated an HQ of 0.54 based on dermal exposure to a residential child playing in wet soil at the site and assuming an EPC of 2.8 mg/kg. Although very conservative, and likely unrealistic, assumptions were used in this calculation, it is clear that the dermal contact exposure pathway may contribute to the cumulative risk value.

I've attached the quickly prepared calculation spreadsheets to this email. Please note that there are two worksheets in the files: one with calculations based upon chemical-specific parameters for Arochlor-1260 as presented in the Risk Assessment Information System (RAIS), and the other with the parameters used in the COA report.

Please contact me with questions or comments.

Thank You, Eppie Havel

Eppie V. Havel
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November 18, 2004

Sharon Richmond, Environmental Specialist III
Division of Spill Prevention and Response
Alaska Department of Environmental Conservation
610 University Avenue
Fairbanks, AK 99709-3643

RE: Statistical Analysis of Risk Assessment Calculations, No DoD Action Indicated (NDAI) – Category IV, Pedro Dome Radio Relay Station, Fox, Alaska

Ms. Richmond:

Thank you for choosing OASIS Environmental, Inc. (OASIS) to perform a review of the above referenced risk assessment calculations. OASIS understands that the only remaining contaminant of concern at the Pedro Dome Radio Relay Station is polychlorinated biphenyls (PCBs). The Corps of Engineers (Corps) completed an EPA-approved risk evaluation for the site using 2.8 mg/kg (95% Upper Confidence Limit [UCL]) as the exposure point concentration (EPC). Risk calculations were run assuming a residential scenario with exposure to surface soil via direct ingestion and inhalation of volatiles. The calculated cumulative cancer risk was $7X10^{-6}$, which is below the ADEC standard of $1X10^{-5}$. The cumulative hazard index (HI) was 1.4, which exceeds the ADEC risk standard of 1.0. The Corps requested that ADEC approve a risk-based alternative cleanup level for the site.

The Alaska Department of Environmental Conservation's (ADEC) concerns are twofold: 1) is the analysis consistent with U.S. Environmental Protection Agency (EPA) guidance on determining a hazard index; and 2) are the statistical approach and conclusions valid?

OASIS evaluated the risk calculations for consistency with the latest applicable ADEC and EPA guidance, including the State of Alaska *Risk Assessment Procedures Manual* (ADEC, 2000), *Cumulative Risk Guidance* (ADEC, 2002), *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part A) – Interim Final* (EPA, 1989), *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites* (EPA, 2002) and *Guidance for Data Quality Assessment: Practical Methods for Data Analysis* (EPA, 2000). The results of the review are presented in this letter report.

Hazard Index Determination

The calculation of the noncarcinogenic HI in Appendix B of the Pedro Dome report was completed in accordance with ADEC and EPA guidance; however, there are some

issues around the HI calculation that should be discussed with regard to their potential impact on the risk calculations:

- Hazard quotients (HQ) for the ingestion and inhalation pathways were calculated correctly by dividing the exposure level (intake) by the applicable reference dose; however, the hazard index (HI) calculation could be evaluated further. The HI typically is calculated by summing HQs across all pathways that are affecting the same target organ (or system endpoint). This is important because the same chemical may have different noncarcinogenic effects when ingested versus inhaled or dermally contacted. The addition of HQs for dissimilar endpoints may result in an overestimation of risk.

  The Pedro Dome PCB HI was calculated without segregating the HI by endpoints. Based on a quick search of the Risk Assessment Information System (RAIS), it appears that all routes of exposure to PCBs may result in almost immediate dermal and mucosal impacts, but that long-term noncarcinogenic effects may vary. Exposure to PCBs by ingestion apparently leads to hepatic dysfunction, while inhalation largely results in additional dermal effects. One may argue that once PCBs are absorbed through ingestion or inhalation (or dermal exposure), they act similarly on human organs; however, this should be clearly presented in the risk evaluation.

- With regard to the HI significant figures issue, the report correctly cites EPA's reference (RAGS Part A, Exhibit 8-3) that all hazard indices and hazard quotients be expressed as one significant figure; however, ADEC's *Cumulative Risk Guidance* clearly states the cumulative noncarcinogenic hazard index (HI) must be equal to or less than 1.0, with two significant figures (ADEC, 2002). Risk assessment calculations typically err to the conservative, in which case two significant figures should be used.

Statistical Analysis

The Corps used D'Agostino's D-statistic to test the normality of the PCB sample data set and the Land H-statistic to calculate the 95% UCL. The Corp used both statistical methods correctly according to information presented in Gilbert (1987) and EPA (2002); however, D'Agostino's D-statistic is not among the goodness-of-fit methods recommended by EPA in their latest guidance documents nor is it used in the preferred statistical package ProUCL. All UCL computation methods contained in the EPA guidance documents are available in ProUCL (Sing et al., 2004).

When all post-remedial action soil PCB results were entered into ProUCL, the resulting analyses indicated the data were highly skewed (2.15) and the distribution was neither normal nor lognormal by Lilliefors statistic, nor did the data fit a gamma distribution (see attached ProUCL report). For data sets which do not fit a normal, gamma or lognormal distribution, a non-parametric Chebyshev UCL or Hall's bootstrap UCL (for small data sets) of the mean can be used to estimate the EPC (Singh et al., 2004). For a non-parametric highly skewed data set with a sample number ≥50 (like the Pedro Dome data set), EPA recommends the use of the 97.5% Chebyshev (Mean, Sd) UCL. For the data set used in calculating the EPC at the Pedro Dome site, the 97.5% Chebyshev (Mean, Sd) UCL is 2.24 mg/kg.

For reasons that are unclear, all soil data (including subsurface results) were used in the surface soil exposure point concentration calculations. For a more representative EPC and unless further subsurface activities are proposed, OASIS recommends modeling exposure to surface soil only. When only surface soil results are evaluated (with substitution of ½ the method detection limit for non-detects), the data follow both a

lognormal and gamma distribution. Because the data are highly skewed (1.96), the Land's H-statistic based 95% UCL based upon a lognormal model may result in an unjustifiably large and impractical 95% UCL value (Singh et al., 2004); therefore, the gamma model was used to compute a 95% UCL of 1.11 mg/kg. Using this value as the EPC, the calculated cumulative HI for exposure via ingestion and inhalation of volatiles is 0.57.

Please contact us if you have any questions.

Respectfully submitted,
OASIS Environmental, Inc.

Eppie V. Havel
Senior Scientist

Max Schwenne
Project Manager

Attachments: ProUCL Report

References:

ADEC, 2000. *Risk Assessment Procedures Manual*. June 8, 2000.

ADEC, 2002. *Cumulative Risk Guidance*. November 7, 2002.

EPA, 2000. *Guidance for Data Quality Assessment: Practical Methods for Data Analysis*. EPAQA/G-9 QA00 Update. EPA/600/R-96/084. July 2000.

EPA, 2002. *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites*. OSWER 9285.6-10. December 2000.

Gilbert, R.O., 1987. *Statistical Methods for Environmental Pollution Monitoring*. Van Nostrand Reinhold, New York, New York, pp. 160-162.

Singh, A., Singh, A.K. and R.W. Maichle, 2004. *ProUCL Version 3.0 User Guide*. EPA/600/R04/079. April 2004.

	RME=1.11 mg/kg	RME=2.8 mg/kg
Incidental Soil Ingestion		
Intake:	1.09E-05	2.76E-05
HQ:	0.55	1.38
Inhalation of Volatiles		
Intake:	4.10E-07	1.04E-06
HQ:	0.02	0.05
Dermal Contact		
Intake:	4.28E-06	1.08E-05
HQ:	0.21	0.54
Cumulative Risk		
HI:	0.78	1.97

Tox Values

RfD mg/kg-d	2.0E-05
Sf $(mg/kg-d)^{-1}$	2.0E+00

$VF = Q/C*(3.14*D_A*T)^{0.5}*10^{-4}$ $m^2/cm^2/(2*\rho b*D_A)$	m^3/kg	1.33E+06
$DA = [(\theta_a{}^{10/3}*D_i*H'+\theta w^{10/3}*D_w)/n^2]/\rho b*K_d+\theta_w+\theta_a*H'$	m^3/kg	1.5E-08
Inv of mean conc at center of 0.5 acre area (Q/C)	g/m^2-s per kg/m^3	90.80
Exposure Interval (T)	s	9.5E+08
Dry soil bulk density (ρb)	g/cm^3	1.50
Soil particle density (ρs)	g/cm^3	2.65
Total soil porosity (n) = 1-(ρb/ρs)	L_{pore}/L_{soil}	0.434
Water filled soil porosity (θw) = wρb	L_{water}/L_{soil}	0.24
Air filled soil porosity (θa) = n-wρb	L_{air}/L_{soil}	0.20
Avg soil moisture content (w)	g_{water}/g_{soil}	0.10
Fraction organic carbon (f_{oc})	g/g	0.001
Diffusivity in air (D_i)	cm^2/s	1.4E-02
Diffusivity in water (D_w)	cm^2/s	4.3E-06
Henry's Law Constant (H')	Unitless	1.4E-02
Soil-water partition coefficient (K_d)	cm^3/g	2.1E+02
Organic carbon partition coefficient (K_{oc})	cm^3/g	2.1E+05

From RAIS (2004) at http://risk.lsd.ornl.gov/cgi-bin/tox/TOX_select?select=csf:

Chemical	CAS #	Absorption Factor, Dermal	Diffusivity in Air(cm^2/s)	Diffusivity in Water(cm^2/s)	Unitless Henry's Law Constant	Organic Carbon Partition Coef. (L/kg)
Aroclor 1260	11096825	0.14	0.0138	4.32E-06	0.0137	207000